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Technical Bulletins: Sand for Wastewater Drying Beds

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Sand For Wastewater Drying Beds

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Drying beds for wastewater sludge require a specific type of sand in order to dewater the sludge quickly. Many wastewater plants use whatever is available through the local building supply or concrete retailer, which is often a poor choice. Masonry sand is very fine and will not drain the water away from the sludge. For faster drying, choose a coarse sand that will hold the solids but allow the water to drain.

Design Criteria

Sand is classified according to two criteria. The first is the size or diameter of the sand particles called the effective size. The second is the uniformity of the particles, called the coefficient of uniformity.

The coefficient of uniformity tells the purchaser if the sand particles are uniform. A coefficient of uniformity of 1.0 means that all the sand particles are exactly the same size. This is never the case, particles will always have some variation in size.

The effective size tells the purchaser that 90 percent of the particles are larger than the effective size and 10 percent of the particles are smaller then the effective size. This smallest 10 percent determines the speed of draining from a drying bed. The greater the amount of small particles and dust in the sand, the longer it takes for the solids to dry.

The state design criteria specifies that:

- the top course (in the drying bed) shall consist of at least nine inches of sand with a uniformity co-efficient of less than 3.5;
- for trickling filter sludge, the effective size of the sand shall be between 0.8 to 3.0 mm; and
- for waste activated sludge, the effective size of the sand shall be between 0.5 to 0.8 mm.

Sands of these sizes will provide excellent dewatering. However, they are expensive and hard to find. Because of these problems, many facilities use whatever is easily available, which in most cases is construction sand that is too fine to dewater bio-solids quickly.

General Size Classifications

Sand sizes are determined by the amounts that will pass through each of a series of sieves. Coarse sand will pass through a No. 4 sieve with an opening size of 4.76 mm, but not pass through a No. 10 sieve with openings of 2.0 mm. Medium sand will pass through a No. 10 sieve but not through a No. 40 with openings of 0.42 mm.

Fine sand will pass through a No. 40 sieve, but not a No. 200 sieve with openings of 0.074 mm. Coarse sand is used for trickling filter plants, whereas medium sand will work best for activated sludge plants. NEVER use fine sand on the drying bed. Fine sand is used for

mixing mortar and cement and also in golf course sand traps. If you use this type of sand in a drying bed, expect the sludge dewatering to be very slow. In addition, after a fine sand has contaminated the coarse sand and gravel media of the bed, water movement through the media will be slowed from that point on or until the entire media bed is replaced. The reason is that the fine particles and dust in the fine sand move down into the coarser media clogging the media and slowing water movement.

Many parts of the state have river sand available. Natural sands often do not meet state specifications for drying beds. However, they are far superior to construction sand and are economical to purchase. There are also some manufactured sands and other similar products that will function in the drying bed. Use of these "junk sands" are more economical than sand that meets the state's exact specifications. And with careful selection, they can dewater sludge just as well.

Sieve Test Results

Sieve Size	No. 1 Percentage Passing	No. 2 Percentage Passing
4		99.9
8		97.8
10	100	96.4
14	85.7	
16	58.9	80.5
20	10.7	
30	3	28.2
40	1.0	
50	0.6	5.5
100		0.8

Table No. 1

Examples

Table 1 shows the results of sieve tests done on two types of sand. Sand No. 1 is an AWWA (America Water Works Association) approved filter sand that has been washed and graded to specifications of 0.75-0.85 mm. This is excellent sand for drying beds, but it is also expensive. The cost is more than $20 per ton in Junction City, Georgia. The No. 2 sand is from the Nolichucky River and costs less than $5 per ton in Greeneville, TN.

The results of these analyses are plotted on semi-logarithmic graph paper and show a graduation curve for each product. (See *Figure No. 1* on page 3.) The No. 1 sand has an effective size of 0.82 mm. This is the point where the graphed line crosses the ten percent horizontal line. This tells an operator that ten percent of the sand will be smaller than 0.82 mm. The smaller the effective size, the finer the sand, which means that dewatering will be slower.

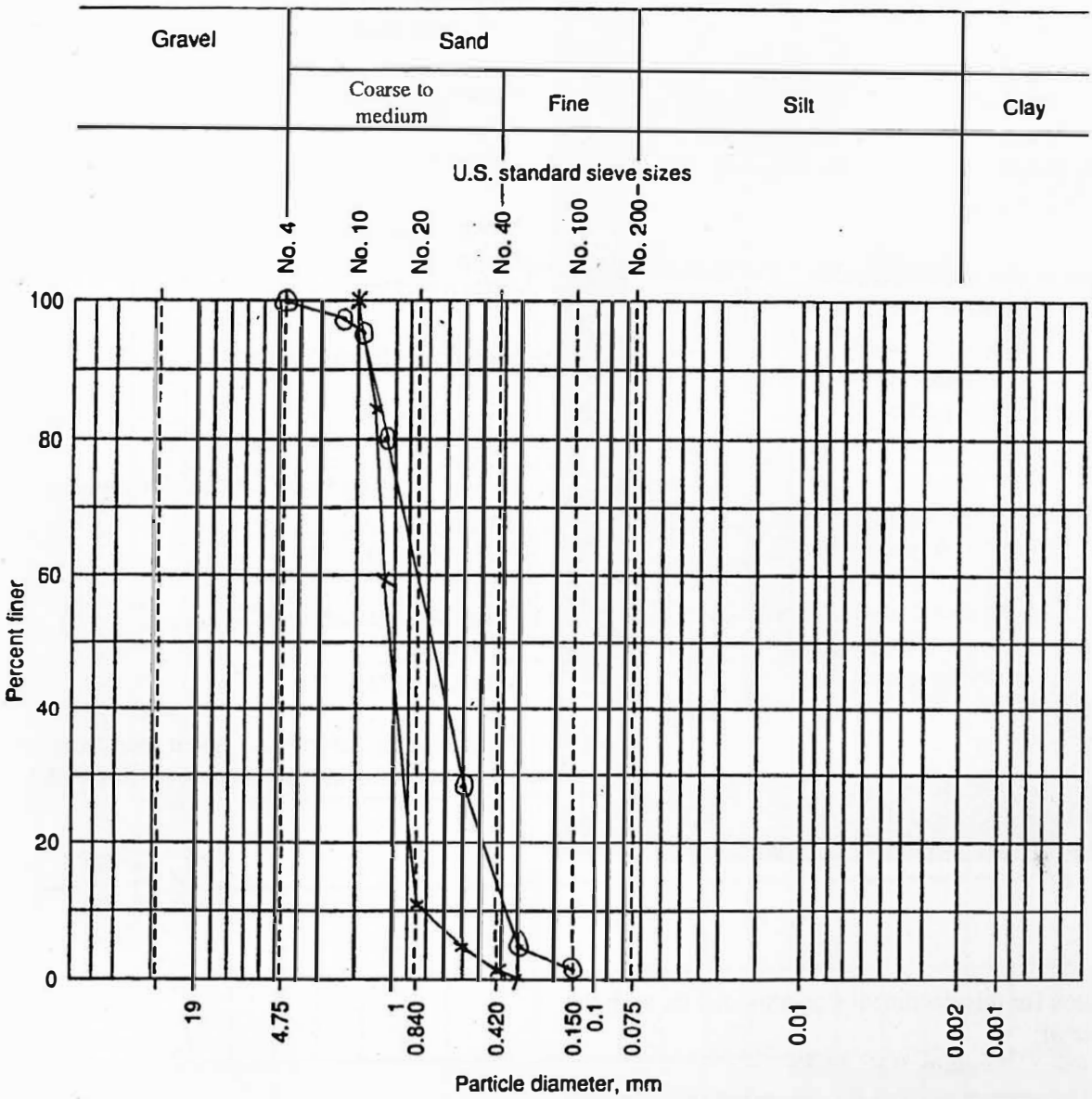
Another important requirement for the sand is the coefficient of uniformity. This is found by dividing the size at the 60 percent line by the effective size at the 10 percent line. Sand No.1 is 1.18 mm/.82mm = 1.44, proving that this is a very uniform sand. Sand No. 2 has a coefficient of .95 mm/.35 mm = 2.7. Both of these sands meet the state specification that the sand must have a uniformity coefficient of less than 3.5.

The most important part of choosing sand for a wastewater sludge drying bed is to use a coarse sand. When purchasing sand, request that the supplier provide you with the effective size and coefficient of uniformity. If they cannot, request a sieve analysis and use the enclosed graph on page 5 to construct your own gradation curve. This can be used to calculate the needed specifications. Choose the sand to use in your drying beds by comparing the effective size and coefficient of uniformity of the available sands with the state specifications for your type of plant.

The closer you can get to this ideal effective size and coefficient of uniformity, the quicker your sludge will dewater. If you have a sand available that is very close to state specifications and is economical to purchase, use it. If your available sands are not close to state specifications, continue to search for a better source of sand. The effort put forth to find a coarse, uniform sand will be rewarded many times over through faster dewatering of bio-solids and more efficient use of the plant facilities.

Plotting Gradation Curves

Figure No. 1



X	Porter Warner .75 - .85mm	effective size = .82mm	Cu = 1.46
0	Nolichuncky River Sand	effective size = .35	Cu = 2.7

Sand Bed Management Tips

- Clean bio-solids thoroughly from the sand. Rake sand to remove the small bio-solids.
- Prepare the surface by using a garden tiller to loosen the sand. Or loosen by stabbing the sand with fork and rocking it side to side.
- Leave the surface rough to allow the sand to dry.
- Level sand immediately before applying an application of bio-solids.
- To accelerate drying, consider covering partially dried bio-solids with a plastic sheet during wet weather. When the sun returns remove the plastic to allow drying to continue.

The following sand suppliers can be contacted for the availability of coarse sand.

American Sand Supply
Monterey
(931) 839-2241

French Broad Sand and Gravel
Knoxville
(423) 579-0051

Newport Sand and Gravel
Newport
(423) 623-7321

Nolichucky Sand Company
Greeneville
(423) 638-5269

Teague Brothers Sand and Gravel Company
Parsons
(901) 847-0848

Porter Warner Industries
Chattanooga
(423) 266-4735

For additional information about sand, contact Steve Fishel at TDEC in Nashville, (615) 532-0660.

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GRADATION TEST

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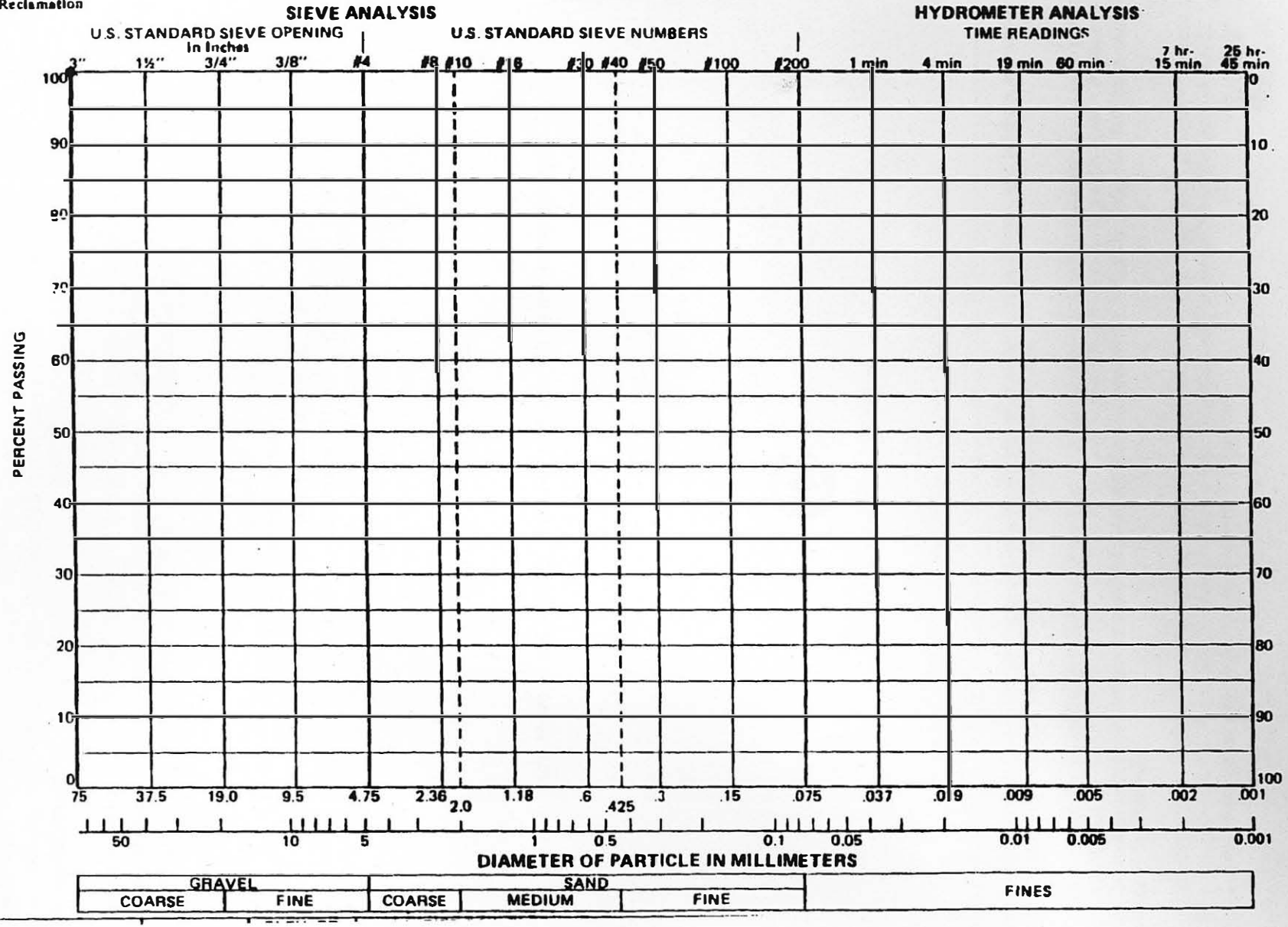

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FIGURE _____

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